drainage would be cold. Peculiar assemblage of different generic characters in the specimen studied could be the sequel of interbreeding and long isolation, thereby inducing speciation.

The water from the cave was pumped out for a few days by the mining department of Hindustan Zinc Ltd. for their use without our knowledge. It was then reported that several kilograms of fish were collected during this operation. This fish catch was allowed to be taken by the tribals residing nearby for their consumption. It is possible further specimens may not be available for confirmation of the above findings and further study. However, attempts are now being made to explore the cave further as it still contains water of shallow depth and thus may harbour ichthyologically interesting finds.

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28. MATING AND OVIPOSITION BEHAVIOUR OF TEA MOSQUITO BUG *HELOPELTIS ANTONII* SIGNORET (HETEROPTERA: MIRIDAE)[1]

INTRODUCTION

The tea mosquito bug *Helopeltis antonii* Signoret (Heteroptera: Miridae) is the most serious pest of cashew *Anacardium occidentale* L. in India. The adults and nymphs of the pest feed on the sap of tender shoots, panicles and immature fruits resulting in their drying up. Though the biology of the pest is known, details of its mating and oviposition behaviour are not well documented except for the brief reports of Ambika and Abraham (1979) and Jeevaratnam and Rajapakse (1981). The mating and oviposition behaviour of *H. antonii*, observed mainly under laboratory conditions, is reported in detail in this communication.

MATERIAL AND METHODS

To observe the various sequences of mating events, male and female adult bugs were introduced in pairs into glass chimney cages and tender shoots of cashew were provided as food material. For studies on oviposition, mated females were maintained in separate cages with tender cashew shoots that were changed daily and also examined for the eggs laid. These studies were carried out in the laboratory under a mean temperature range of 27.8-33.4°C and a relative humidity of 56-73%. Observations were also carried out in the field at the cashew plantations of Central Plantation Crops Research Institute at Vittal.

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Results and Discussion

MATING BEHAVIOUR

1. *Arousal*: The mating process is always initiated by the male. Sexual identification is mainly by visual stimuli and occurs when a female comes in the close vicinity of a male. Once the male comes in contact with a female the following sequence of activity occurs in rapid succession. The male becomes alert and appears to be visibly agitated as seen by its movements. The male begins to probe lightly over the entire body surface of the female with its antenna; this phase of antennal contact lasts for a very short period (10-30 sec.) and probably serves to physically stimulate the female. A receptive female's response to the male's activity is passive, whereas a non-receptive female moves away quickly from the male. Thus, courtship is brief and not elaborate.

2. *Mounting*: The male then mounts the female generally from the posterior region. The rostrum of the male is erect and it appears to stroke lightly over the dorsal region of the female just below the thoracic shield. The stroking activity of the male probably has a quietening effect on the female for insertion of the aedeagus. During this phase, which is also brief (25-60 sec.) the male bends the tip of its abdomen towards that of the female. The aedeagus is then extruded and kept erect and is observed to make thrusting movements for the insertion of the same into the genital aperture of the female. In certain cases when the female did not appear to admit the aedeagus, the male moved it side to side across the genital area of the female until insertion was achieved. In certain cases females attempted to dislodge males by vigorous kicking and shaking movements. Dislodged males immediately attempt to mount again and in some cases insertion of the aedeagus is achieved in the second or third attempt.

3. *Copulation*: As soon as the aedeagus enters the genital chamber of the female the male twists around and copulation occurs in an 'end to end' position. Copulatory pairs remain stationary and exhibit very little body movements unless disturbed and do not feed. Copulation lasts for a mean period of 51 min. (n = 15; range: 27-81 min.). Jeevaratnam and Rajapakse (1981) have mentioned that mating pairs remain *in copula* for 10 min.-2 h.

4. *Termination of copulation*: The disengagement of the copulatory pair is rather abrupt. Both sexes struggle for a short period (30-50 sec.) before succeeding in doing so. With the termination of mating, they move away to a short distance and begin to feed immediately; sometimes they also clean their antennae, appendages and genitalia. Females that have just mated do not respond to attempts of other males to mate with them.

The mating behaviour was similar under laboratory and field conditions. Mating was observed to occur throughout the day, both in the laboratory and in the field. In the field when the temperature is high, mating pairs have been observed under leaves and other similar shaded situations. The role of sex attractant pheromones in the attraction and recognition of the sexes in the field cannot be ruled out. Smith (1977) has demonstrated the presence of a sex attractant pheromone in adult females of *H. clavifer*, a pest of cacao in Papua New Guinea.

OVIPOSITION BEHAVIOUR

The eggs are inserted into the tissues of tender stems and inflorescence stalks as reported by Ambika and Abraham (1979) and Jeevaratnam and Rajapakse (1981). On the latter they are generally oviposited on the main rachis and rarely on the secondary rachis. In some cases, eggs are laid in the mid-rib of leaves especially in the ventral region, and also in the petioles. The eggs are laid either singly or in groups of 2-4. An examination of 500 sample eggs showed that 43.6 per cent of them were laid singly. When the eggs are deposited in groups they occur in a single row or in two rows. Egg laying occurs mainly during the night but has also been observed during the day.

Just prior to oviposition the female probes the plant tissues for a suitable site with the tip of its rostrum. As soon as a suitable site is selected the female bends its abdomen and extends the ovipositor so as to establish contact with the plant tissue. The tarsi of all the pairs of legs firmly grip the substratum. The ovipositor is then inserted into the plant tissue and the abdomen is observed to distend and contract until an egg is deposited at an angle below the epidermis in the parenchymatous tissue. The ovipositor is then soon withdrawn. During the process of oviposition the antennae are held forward and slightly bent. The site of oviposition is difficult to trace immediately after it is completed; however, a browning of the region occurs in 1-2 days. A pair of silvery white chorionic processes of the egg which are unequal in length protrude outside the plant tissue and can be easily recognised with the aid of a magnifying glass.

The mean duration of preoviposition and period in the present study was 3.6 days (n = 15; range: 3-5 days) and 7.4 days (n = 15; range: 5-10 days) respectively. The mean number of eggs laid by a female was 48.1 (n = 15; range: 24-71 eggs). The pattern of oviposition in relation to duration of oviposition period is given in Table 1. More than 75 per cent of the eggs were laid during the first half of the oviposition period.

TABLE 1

PATTERN OF OVIPOSITION IN *Helopeltis antonii*

Day of oviposition	No. of eggs laid per female*
1	7.9
2	7.5
3	7.7
4	7.3
5	6.3
6	4.5
7	3.7
8	1.9
9	0.8
10	0.3

* Values indicate mean of 15 replications.

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29. YOUNG LAC INSECTS IN A MINIATURE ANT'S NEST

Many insects live underground and so do most species of ants. A typical case would be of the common black ant, *Camponotus compressus.* On the contrary there are insects which build their nests in elevated areas or on tree tops. Such an insect would be the honey-bee. Then there is an ant which builds its nest on trees, and it is *Oecophyla smaragdina.* Prof. Doflein, who was Professor of Zoology, Freiburg University, Germany, before the First World War, as Zoologist, toured over Southern Asia, visiting Ceylon as well. Here he observed the ant *Oecophyla smaragdina* building its nest. Living on a tree with broad leaves, some ants tried to hold them close to one another while others glued them together with the secretion of their larvae otherwise destined to become silk-like thread for their cocoons when dried. Thus arose a nest formed of leaves with the size almost two-thirds of an ordinary football. Doflein was the first to illustrate such a nest and also to show the ants bringing separated leaves near each other for being woven into a nest. A subject of my study had been lac. While at Bangalore, I found that the local species, *Kerria mysorensis*, grows best on *Shorea talura.* This has broad leaves of the same size as that of the banyan. Besides the lac insect there was the ant *O. smaragdina.* It had constructed nests, some around the stems on which lac insects were found. Then there were other nests of which the leaves on the undersurface were infested with some scale-insects. Lac insect is also a scale-insect so that the inhabitants of the ants' nests were all scale-insects. They secrete honey-dew which serves as the food of the ant. Thus in effect the ants' nest was like a dairy. There was also evidence to show that ants helped to transplant scale-insects on leaves and increase their number in the nest. The scale-insects then were treated like cows by the ants. As far as I remember Doflein does not mention whether the ants' nest which he observed was populated with scale-insects.

However, like the Asian species *O. smaragdina,* there is one in Africa named *O. longinoda.* E. O. Wilson, the American authority on ants, and Hoelldobler & Wilson (1981) have studied the African ant, which was rehabilitated in a greenhouse in America. Their illustrations confirm the main observations of Doflein. They do mention that the ants "gather the sweet honey dew, the excrement of scale insects". But there is no hint to the effect that the nest was found populated by scale-insects and it functioned like their dairy. This is because their observations refer to a rehabilitated ant colony and not the natural one in Africa.

Whereas the large nests of the two ants *Oecophyla smaragdina* and *O. longinoda* have been illustrated, a similar nest of a small ant remains unrecorded. Lac was cultivated in a small plantation near the village, Dorsanipalia, on the way to Banergatta in Bangalore. The tree was called "Jalari" in Kanarese, which would